DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention picturizes an image pick-up subject using a color imaging device, and relates to the color adjustment especially in the display screen of a color imaging device, and what is called white balance adjustment about the color imaging device which displays the color video image.
[0002]
[Description of the Prior Art]In industrial use or a noncommercial color imaging device (for example, video camera), red, green, and the color adjustment that adjusts a trichromatic blue rate are performed so that the image which picturized the subject and was displayed on the display screen may become as close to the color of the subject seen by people's eyes as possible. Such color adjustment is usually called white balance adjustment (or white balance proofreading).
[0003]A color imaging device in recent years has many which perform white balance adjustment automatically. However, an objective color changes with kinds (available light, a white electric light, a fluorescent lamp, etc.), luminosities, etc. of a light source, and differs from change of the color which human being's eyes feel, and change of the color acquired from an image sensor. For this reason, even when performing white balance adjustment automatically, it is common to have the mode in which color adjustment is performed manually.
[0004]Like [in the case of inspecting the generation state of rust inside an iron pipe, for example using a color endoscope apparatus], there is no white part into the view of a camera, and when it is an approximately same color, automatic white balance adjustment does not function normally. For example, the whole is displayed whitely, without displaying rust in beautiful orange. In order to detect the generation place of rust from the image acquired with a color endoscope apparatus correctly, it is necessary to perform color adjustment manually.
[0005]White balance adjustment (color adjustment) is performed by adjusting the red obtained from image sensors, such as CCD color sensors, and the rate of each green and blue signal component. Usually, in the digital disposal circuit called a camera control unit (CCU), color adjustment is performed by fluctuating the luminosity for a red component and Aoshige on the basis of the luminosity (brightness or luminosity) of a green component.
[0006]In order to perform such color adjustment manually, the directing means of the

switch etc. which direct increase and decrease and the grade of the luminosity for a red component and Aoshige, and the control means (for example, microprocessor) which controls the color adjustment by a digital disposal circuit according to the indicating input are established. And the user of a color imaging device picturizes a subject like a blank paper, for example, and he operates a directing means so that the color of the image displayed on a display may become white.
[0007]Under the present circumstances, making the color adjustment according a subject (blank paper) to hand control by [of a display screen] arranging horizontally immediately, picturizing, and putting in order and viewing a subject and a display picture as easy as possible is performed.
[0008]
[Problem(s) to be Solved by the Invention]However, the image which a subject (blank paper) is not illuminated with always sufficient luminosity, is displayed when lighting is dark becomes gray rather than is white. The brightness and tone of a display picture change also with the construction material and the surface states of paper. In such a case, adjustment (color adjustment) of the white balance by hand control is by no means easy.
[0009]When the image pick-up subject and the display screen of the color imaging device are separated, while viewing compares the tone of the image displayed as the tone of the image pick-up subject, it becomes still more difficult to perform color adjustment.
[0010]The above-mentioned color adjustment method cannot be used for the color adjustment referred to as setting rust in the above-mentioned iron pipe by skillful orange.
[0011]An object of this invention is to provide the color adjustment method for performing easily the manual color adjustment in a color imaging device in view of above SUBJECT.
[0012]
[Means for Solving the Problem]A color adjustment method of a color imaging device by this invention, A color imaging device which picturizes an image pick-up subject, and a digital disposal circuit which performs color adjustment of an output signal of this color imaging device, and generates a color video image signal, A display which displays a color video image of an image pick-up subject according to a color video image signal outputted from this digital disposal circuit, It is the color adjustment method of a color imaging device provided with a control means which controls color adjustment by a digital disposal circuit, and a directing means which directs the contents of color adjustment to this control means, It puts on a color video image of an image pick-up subject displayed on a display, and brightness of a specific color displays a brightness scale pattern which changes gradually, and a directing means is operated so that a foreground color of an image pick-up subject whose color is known may become close to one portion of the brightness scale patterns.
[0013]Since comparison with a color video image and a brightness scale pattern can perform color adjustment on a screen of a display according to such composition, compared with a case where a display on a screen like before is compared with a subject, color adjustment can be performed easily. Since brightness should just set a display picture by one portion of the brightness scale patterns which change gradually even if it is a case where a display picture becomes dark, since the luminosity of lighting is insufficient, adjustment is easy.
[0014]Preferably, a brightness scale pattern is a gray scale pattern which changes

gradually from white to black, a directing means is operated and white balance adjustment is performed so that a foreground color of a white image pick-up subject may become close to one portion of the gray scale patterns. Usually, what is necessary is just to display an orange brightness scale pattern on a color video image of an image pick-up subject in piles, in order to perform color adjustment so that rust in an iron pipe may be displayed in beautiful orange, for example although what is necessary is just to perform white balance adjustment using such a white subject (for example, blank paper).
[0015]A color imaging device by this invention for enforcing above color adjustment methods is provided with the following.
A color imaging device which picturizes an image pick-up subject.
A digital disposal circuit which performs color adjustment of an output signal of this color imaging device, and generates a color video image signal.
A control means which controls color adjustment by this digital disposal circuit.
A directing means which directs the contents of color adjustment to this control means, and the 1st video memory that memorizes the 1st indicative data generated based on a color video image signal outputted from a digital disposal circuit, The 2nd video memory that memorizes the 2nd indicative data in which brightness of a specific color contains a brightness scale pattern which changes gradually, A display which displays a brightness scale pattern on a color video image of an image pick-up subject in piles based on a video signal obtained from data which superimposed the 2nd indicative data read from the 2nd video memory to the 1st indicative data read from the 1st video memory.

[0016]
[Embodiment of the Invention]Hereafter, the embodiment of this invention is described, referring to drawings.
[0017]Drawing 1 is an outline view of the color imaging device concerning the embodiment of this invention. This color imaging device is an endoscope of industrial use, it has the camera part 1 and the controller part 2, and both are connected with the signal cable 3.
[0018]The camera part 1 is provided with the following.
The cylindrical head 11 which builds in a color imaging device (CCD series).
Hand operation box 12.
The flexible tube 13 which connects both.
Although a detailed graphic display is omitted, the annular illumination part which used white LED (light emitting diode) is provided at the tip of the head 11, and the light-receiving lens is arranged in the center section. Image formation of the image of an image pick-up subject is carried out to the CCD series in the head 11 through a light-receiving lens.
[0019]The switch for luminosity (signal gain) adjustment, the frieze switch which makes an image stand it still, and the zoom change-over switch which switches the double zoom of an image are formed in the hand operation box 12, and a hand can perform these operations apart from operation of the controller part 2. The digital disposal circuit called the camera control unit (CCU) for processing the output signal of CCD series is built in the inside of the hand operation box 12.
[0020]The controller part 2 displays the color video image of an image pick-up subject from the color video image signal which was picturized by the camera part 1 and

transmitted through the signal cable, and it is provided with the liquid crystal display 21 which performs the display for various operations. This liquid crystal display 21 can be folded up when not using it, and the whole controller part 2 becomes compact rectangular parallelepiped shape. Thereby, the controller part 2 can be carried quite easily.

[0021]Various operation switches are formed in the upper surface left-hand side of the controller part 2. 22 is a picture recording switch for recording the image data obtained from the picturized video signal on a memory card. 23 is a switch for attaching a voice note to image data and recording it. 24 is a switch of the same function as the frieze switch formed in the hand operation box 12, and when making the image currently displayed on the display 21 stand it still, it is operated. 25 is a switch and decision (Enter) switch for the four quarters. According to the screen for setting out displayed on the display 21, various setting out can be performed by pushing this switch 25 vertically and horizontally. If a center section is pushed, it will function as a definite (Enter) switch and a setting detail will be become final and conclusive. 26 is a menu switch. By pressing this key, menus, such as a mode change, are displayed on the display 21. 27 is canceled (Esc) and is a key. By pressing this key, the last setting detail is canceled or it returns to the last display.

[0022]The slot 28 for memory card insertion is formed in the front side face of the controller part 2. Although the graphic display is omitted, the protection door of the slot 28 for memory card insertion is provided actually, and if a protection door is opened, the slot 28 for memory card insertion can be accessed. A memory card is the nonvolatile removable recording medium which used the flash memory, and is used for an above-mentioned picture and record of a voice note. Voice input connects a microphone to the jack 29 for voice input provided in the right lateral of the controller part 2, and is performed to it.

[0023]Drawing 2 is a block diagram showing the main circuitry of the color imaging device concerning the embodiment of this invention. The camera part 1 is provided with CCD series 31, A/D converter 32, the digital signal processor (DSP) 34, and D/A converter 35. A/D converter 32, the digital signal processor (DSP) 34, and D/A converter 35 constitute what is called a camera control unit (CCU).

[0024]After the red, the green, and the individual blue light-receiving signal which are outputted from CCD series 31 are changed into digital value with A/D converter 32, respectively, they are inputted into DSP34. DSP34 compounds the red, the green, and the individual blue light-receiving data which were inputted, and generates the color video image data of each pixel. Under the present circumstances, the color adjustment which fluctuates red and blue luminosity on the basis of a green luminosity (luminosity) is performed. This color adjustment is performed according to the instructions from the controller part 2. The color video image data outputted from DSP34 is changed into an analog signal with D/A converter 35, serves as a video signal (NTSC signal), and is transmitted to the controller part 2.

[0025]The controller part 2, [others / the above-mentioned display 21 and the operation switches 41 (22-27)] It has the microprocessor (CPU) 42, the video decoder 43, the video memory controller 44, the 1st video memory 45, the 2nd video memory 46, the video encoder 47, and the memory card controller 48.

[0026]The video signal transmitted from the camera part 1 is changed into YUV image data by the video decoder 43 with a built-in A/D converter. This image data is once

memorized by the 1st video memory 45 through the video memory controller 44. When performing stillness (frieze) of a display image, a screen separation display, etc., the image data read from the 1st video memory 45 is passed to the video memory controller 44. The image data passed to the video memory controller 44 from the video decoder 43 or the 1st video memory 45 is changed into a video signal with the video encoder 47 with a built-in D/A converter, and is displayed on the display screen of the display 21.
[0027]CPU42 controls the video memory controller 44 according to the display mode inputted from the operation switches 41, and it writes indicative datas, such as various set menus, in the 2nd video memory 46. The image data from the video memory controller 44 is overlapped on the indicative data read from the 2nd video memory 46 with the video encoder 47. As a result, when the indicative data is written in the 2nd video memory 46, the image (it superimposed) which the set menu display etc. put on the image of the image pick-up subject is displayed on the display 21.
[0028]CPU42 controls record of the image data to the above-mentioned memory card 51, and voice data via the memory card controller 48. On the contrary, image data and voice data can be read from the memory card 51, and it can also reproduce. The reproduced picture is displayed on the display 21 and a sound is outputted from the loudspeaker (not shown) and audio output terminal (not shown) which were built in the controller part 2.
[0029]CPU42 gives color adjustment instructions to DSP34 of the camera part 1. That is, they are the instructions which fluctuate red and blue luminosity on the basis of green luminosity as mentioned above. There are automatic mode and a manual mode in color adjustment (white balance adjustment). In automatic mode, DSP34 judges a white balance from image data automatically, and performs color adjustment. In a manual mode, CPU42 gives color adjustment instructions to DSP34 according to the directions inputted from the operation switches 41. Below, the details of the color adjustment (manual white balance adjustment) by a manual mode are explained.
[0030]Drawing 3 shows an example of the screen for manual white balance adjustments which operates the menu switch 26 of the operation switches 41, and the switch and settlement switch 25 for the four quarters, and carries out a superimposed display to the display 21. Title "manual white balance adjustment" 62 of a screen are displayed on the upper left of the display screen 61, and the present red and blue luminosity setting level is displayed on left-hand side by the bar graphs 63 and 64. It is shown that it is equal to the green luminance level which is a standard if the length of a bar (coloring portion) is the whole half, if shorter than a half, it is lower than a green luminance level, and if it excels from a half, it is shown that it is higher than a green luminance level. However, it is not comparison in the absolute value of a luminance level but comparison with the luminance level amended according to each color standard luminance level sensed that people's eyes are equal.
[0031]Each buttons 65, 66, 67, and 68 of determination, red, blue, and linkage are displayed on the right-hand side (central lower part of Screen 61) of the bar graphs 63 and 64. operating the switch and settlement switch 25 for the four quarters -- the red button 66 -- choosing (it is made to highlight) -- a red luminance level can be made to fluctuate It can be made to make increase a luminance level or decrease by pushing a part for a part for the upper part, and the lower part of the switch and settlement switch 25 for the four quarters. If the blue button 67 is chosen similarly, a blue luminance level can be made to fluctuate. If the interlocking button 68 is chosen, a red and blue luminance level

can be made to fluctuate simultaneously. In this case, if while is [being red and] blue and a luminance level increases, the luminance level of another side will decrease. When a user judges that color adjustment completed the determination button 65, the switch and settlement switch 25 for the four quarters is operated, and it is chosen, and it is pushed (a settlement switch is pushed).

[0032]If operation which fluctuates a red and blue luminance level as mentioned above is performed, the bar (coloring portion) of the bar graphs 63 and 64 in which the present luminosity setting level is shown corresponding to the operation expands and contracts. When CPU42 rewrites the indicative data memorized by the 2nd video memory 46 according to the signal from the operation switches 41 (switch and settlement switch 25 grade for the four quarters), the display of the bar graph 63 and 64 grades changes. CPU42 sends color adjustment instructions to DSP34 of the camera part 1 according to the signal from the operation switches 41 (switch and settlement switch 25 grade for the four quarters).

[0033]As a result, DSP34 performs the color adjustment which fluctuates the red and blue luminosity in the color video image data of each pixel as mentioned above. Thereby, the color of the color video image 69 of the image pick-up subject currently displayed on the background of the display 62 for manual white balance adjustments of Screen 61 - 68 grades changes. Usually, in manual white balance adjustment, a white subject like a blank paper is picturized, and the above operations are performed so that the color of the image displayed on Screen 61 may turn into beautiful white. However, when the luminosity of lighting is insufficient, the display picture 69 becomes a beautiful color which did not become white but is grayish. In addition, there is a case with the beautiful display picture 69 where it does not become white but manual white balance adjustment is difficult, also by conditions, such as construction material (surface reflectance) of paper.

[0034]Then, the color imaging device of this embodiment carries out the superimposed display of the gray scale pattern 70 for comparing easily to Screen 61. In drawing 3, the gray scale pattern 70 from which brightness changes to four steps from white to black is displayed on the right portion of Screen 61. Like [this gray scale pattern 70] other displays 62-68 for manual white balance adjustments, when CPU42 writes an indicative data in the 2nd video memory 46, it is carried out.

[0035]The user of a color imaging device operates the above-mentioned manual white balance adjustment so that the tone of the display picture 69 when the white subject of a blank paper etc. is picturized may become close to the portion of either of four steps of the gray scale pattern 70. Even if it is a case where this becomes the color in which the display picture 69 was grayish, manual white balance adjustment can be performed comparatively easily.

[0036]Drawing 4 is a flow chart which shows the flow of processing of CPU42 in the above manual white balance adjustments (manual color adjustment). However, in order to show the whole processing intelligibly, the user's operation step is also contained.

[0037]In step #101, selection of manual white balance adjustment (manual color adjustment) of operation of the switches 41 will display the screen for manual color adjustment in step #102. That is, as mentioned above, CPU42 writes the indicative data of the screen for manual color adjustment in the 2nd video memory 46, and the superimposed display of Screens 62-68, and 70 for manual color adjustment which contain the gray scale pattern 70 by this is carried out to the background video 69.

[0038]In the following step #103, a user picturizes the white subject of a blank paper etc. The obtained image data is written in the 1st video memory 45, and it is displayed on Screen 61 as the background video 69 (step #104). In step #105, a user operates the switch for color adjustment (switch and settlement switch 25 grade for the four quarters), as mentioned above. As mentioned above, according to the contents of operation of the switch for color adjustment, CPU42 rewrites the stored data of the 2nd video memory 46 so that it may change the display of the bar graphs 63 and 64, and it sends color adjustment instructions to DSP34. As a result, the stored data of the 1st video memory 45 is rewritten, and change of color is reflected in the background video 69 (step #106).
[0039]In step #107, a user compares the tone and the gray scale pattern 70 of the background video 69. Step #105 to step #107 is repeated until the tone of the background video 69 becomes close to one portion of the gray scale patterns 70. If the tone of the background video 69 becomes close to one portion of the gray scale patterns 70, It judges that color adjustment was completed (Yes of step #108), and the switch and settlement switch 25 for the four quarters is operated, the determination button 65 is chosen, and the settlement switch 25 is pushed (step #109). Processing of manual color adjustment (manual white balance adjustment) is completed now.
[0040]As mentioned above, although the embodiment of this invention was described, this invention can be carried out not only with this embodiment but with various gestalten. For example, although brightness is changing to four steps, it may be made for the gray scale pattern 70 in drawing 3 to display the gray scale pattern to which brightness was changed on much more stages.
[0041]This invention is widely applicable to the manual color adjustment not only on the basis of what is called white balance adjustment but a specific color. For example, as explanation of conventional technology and SUBJECT described, when applying this invention to the manual color adjustment of setting rust in an iron pipe by skillful orange, It replaces with the gray scale pattern 70 in drawing 3, and orange brightness should just display on Screen 61 the brightness scale pattern which changes gradually.
[0042]The 1st video memory 45 and the 2nd video memory 46 may be contained in one memory circuit. In that case, the field of the 1st video memory and the field of the 2nd video memory are defined by assignment of an address.
[0043]
[Effect of the Invention]As explained above, according to the color adjustment method of this invention, and the color imaging device. Since comparison with a color video image and a brightness scale pattern (gray scale pattern) can perform manual color adjustment (manual white balance adjustment) on the screen of a display, compared with the case where the display on a screen like before is compared with a subject, color adjustment can be performed easily. Since brightness should just set a display picture by one portion of the brightness scale patterns which change gradually even if it is a case where a display picture becomes dark, since the luminosity of lighting is insufficient, adjustment is easy.

[Translation done.]